Chapter 13
Emotion Recognition Using Facial Expression

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ABSTRACT

Recognition of facial expression is a challenging problem for machine in comparison to human and it has encouraged numerous advanced machine learning algorithms. It is one of the methods for emotion recognition as the emotion of a particular person can be found out by studying his or her facial expressions. In this paper, we proposes a generic algorithms for recognition of emotions and illustrates a fundamental steps of the four algorithms such as Eigenfaces (Principal Component Analysis [PCA]), Fisherfaces, Local Binary Pattern Histogram (LBP) and SURF with FLANN over two databases Cohn-kanade database and IIT BHU student face images as benchmark database.The objective of this book chapter is to recognize the emotions from facial images of individuals and compare the performances of holistic algorithms like Eigenfaces, Fisherfaces, and texture based recognition algorithms LBPH, hybrid algorithm SURF and FLANN. Matching efficiency of individual emotions from facial expression databases are labeled for training and testing phases. The set of features is extracted from labeled dataset for training purpose and test images are matched with discriminative set of feature points. Based on that comparison, we conclude that Eigenfaces and Fisherfaces yields good recognition accuracy on the benchmark database than others and the efficiency of SURF with FLANN algorithm can be enhanced significantly by changing the parameters.

1. INTRODUCTION

The automatic recognition of emotions from facial expression is a well-known problem in field of computer vision, pattern recognition and image analysis. The image analysis includes both computations and measurements from facial motion to recognize the expression. It is getting proliferations in the variety field of applications and uses. But it has major challenges problems due to large intra-class variation, varying

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pose, illumination change, partial occlusion, and cluttered background in the field of computer vision. The research study of facial expression of emotion has long been the focus of theoretical controversy and empirical research (Allport, 1924) (Birdwhistell, 1963) (Coleman, 1949), (Darwin, 1872a,1998b), (Ekman, 1973a, 1994b) (Fridlund, 1999), (Hunt, 1941) (Landis, 1924), (Mead, 1975), (Munn, 1940), (Osgood, 1966), (Russell, 1994), (Schlosberg, 1954) (Woodworth, 1938), (Keltner et al., 2003). However, scientist and researchers have recently made momentous progresses on a particularly interesting subset of object recognition problems: face (Rowley, Baluja & Kanade, 1998), (Viola, & Jones., 2004), (Xiao et al., 2007) and human detection (Dalal N, & Triggs, 2005) achieving near 90% detection rate on the frontal face in real-time (Viola, & Jones, 2004) using a boosting based approach. Meanwhile, with the recent advance on robust facial expression detection, some major image search engines start to use high level image features to filter text based image search results (Cui et al., 2008). For example, recognition of facial expression form given database already integrated human face detection as a high level filter in computer vision approaches. However, designing of efficient algorithm for facial expression of human face is still a challenging problem.

2. BACKGROUND

In literature review, many methods for face and facial expression recognition have been presented; however each of them having their own limitations. In Eigenfaces and Fisherfaces, which are built on Principal Component Analysis (PCA) (Turk, & Pentland, 1991); the more recent 2D PCA and Linear Discriminant Analysis (Etemad, & Chellappa, 1997), (Martinez, & Kak, 2001) are also examples of holistic methods. Although these methods have been studied widely, local descriptors have gained attention because of their robustness to illumination and pose variations. Heiseleet al. showed the validity of the component -based methods, and how they outperform holistic methods. The local-feature methods compute the descriptor from parts of the face, and then gather the information into one descriptor. Among these methods are Local Features Analysis Gabor features (Gabor wavelets (Lanitis et al., 1997), (Dailey, & Cottrell, 1999), Elastic Bunch Graph Matching (EBGM) (Wiskott et al. 1999), and Local Binary Pattern (LBPH) (Ahonen et al., 2006). The last one is an extension of the LBP feature, that was originally designed for texture description (Ahonen et al., 2006). applied to face recognition. LBP achieved better performance than previous methods, thus it gained popularity, and was studied extensively. Newer methods tried to overcome the shortcomings of LBP like Local Ternary Pattern (LTP) and Local Directional Pattern (LDiP). The last method encodes the directional information in the neighborhood, instead of the intensity. Zhang et al. (2003) explored the use of higher order local derivatives (LDEP) to produce better results than LBPH (Ahonen et al., 2006). Both methods use other information, instead of intensity, to overcome noise and illumination variation problems. In (Yang et al., 2004) proposed a novel approach of facial action units (AU) and expression recognition based on coded dynamical features and proposed a method which is implemented using 2D appearance-based local approach for the extraction of intransient facial features and recognition of four facial expressions (Sarode, & Bhatia, 2010) and discussed the paper about the various facial expression databases are available with different variations like illumination, expression, size, shape, color, and texture. Shih et al. (2008) compared the performance ratio on JAFFE database of facial expression recognition (Shih, et al, 2008). Wai Kin et al. (2008) proposed a method based on the 2-D Gabor filter which obtained palm print and texture feature extraction for authentication (Wang et al, 1998). They have described the five modules to get satisfactory results for palm print recognition

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